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PART III

ENVIRONMENTAL PROTECTION AGENCY

■

Requirements for Preparation, Adoption, and Submittal of Implementation Plans

Transportation Control Measures

Title 40—Protection of Environment

CHAPTER I—ENVIRONMENTAL PROTECTION AGENCY

PART 51—REQUIREMENTS FOR PREPARATION, ADOPTION, AND SUBMITTAL OF IMPLEMENTATION PLANS

Transportation Control Measures

On August 14, 1971 (36 FR 15486), the Administrator of the Environmental Protection Agency promulgated as 42 CFR, part 420 regulations for the preparation, adoption, and submittal of State implementation plans under section 110 of the Clean Air Act, as amended (hereafter referred to as the Act). Those regulations were republished November 25, 1971 (36 FR 22369), as 40 CFR, pt. 51, amended December 17 and December 30, 1971.

On January 12, 1973 (38 FR 1464), the Administrator proposed regulations to amend 40 CFR, pt. 51 to clarify the requirements for transportation control strategies that are to be submitted as part of State implementation plans under section 110 of the Act. Interested persons were provided an opportunity to participate in the proposed rulemaking by submitting written comments. The public response included comments from the States of California, Oregon, and Texas; the U.S. Conference of Mayors; the National League of Cities; STP Corp.; Counsel for the Motor & Equipment Manufacturers Association; Ford Motor Co., General Motors Corp., Specialty Equipment Manufacturers Association, Texaco Inc., and Natural Resources Defense Council, Inc.

States suggested that so called "loaded" emissions tests, where used in a program of inspection and maintenance, could result in greater degrees of emissions reduction than were estimated in appendix N to the proposed rulemaking. States and other commentators also suggested that idle tests could be considered valid as an inspection technique. The revisions to appendix N published herein reflect an increase in the estimate of emissions reductions attainable using "loaded" tests that are designed to produce up to a 50 percent initial failure rate. In addition, values are now included for an "idle" test at about two-thirds the values for loaded tests under similar initial failure rates. These revisions reflect a further review of test data subsequent to publication of the report "Control Strategies for In-Use Vehicles," November 1972. The increase in the estimate of emissions reductions attainable with the "loaded" test is attributable to use of the 1975 Federal test procedure instead of the 1972 procedure. This change in test procedure is considered appropriate, as the emissions factors whose use is directed in § 51.14(f) are based on the 1975 test procedure. Estimates of emissions reductions achievable through idle emissions testing programs were not included in the notice of proposed rulemaking owing to the possibility that idle test requirements might be satisfied with combinations of engine adjustments that produce little or no reduction in mass emissions. Further review of this matter has indicated that this problem can be avoided through the addition to the idle emissions test procedure of a requirement that certain engine adjustments be performed to manufacturer's specifications. Therefore, appendix N has been modified to include estimates of emissions reductions achievable through idle emissions testing combined with the appropriate engine adjustments. The cited emissions reductions are based on the experimental studies cited in the EPA report "Control Strategies for In-Use Vehicles." The changes to appendix N, however, reflect certain information and data not available at the time of publication of this report and the notice of proposed rulemaking. EPA plans to update this background document to include these more recent data on which the revisions to appendix N were based.

States also expressed concern that the detailed guidance provided in appendix N might restrict their flexibility to use alternative retrofit approaches or emissions reduction estimates. Sections 3(d) and 4(d) of appendix N allow alternative approaches and emissions reduction estimates based on sufficient test data.

Equipment manufacturers expressed concern that State inspection/maintenance programs may affect the consumers' freedom to select parts suppliers or repair facilities for accomplishing necessary maintenance. The guidelines do not mandate any such restrictions beyond requiring that State programs include means of ensuring that suitable maintenance is performed on vehicles that fail inspection.

A petroleum company commented that it would not be possible to provide lead-free fuel of suitable octane value for retrofit catalyst control. EPA has concluded that extensive supplies of lead-free "high" octane fuel may not be available nationwide. However, on a limited scale, in particular areas, the availability of this fuel is possible. Appendix N has been modified to give additional emphasis to the need to investigate the availability of this type of fuel in specific implementation plans. The petroleum company also commented on the potential effects of retrofit on fuel economy and driveability. The test data available to EPA and presented in "Control Strategies for In-Use Vehicles" indicate no serious effects on fuel economy or driveability as a consequence of retrofit.

An environmental group suggested that the guidelines include requirements to assure continuing maintenance of the national ambient air quality standards for motor-vehicle related pollutants. Proposed rulemaking on this matter was published April 18, 1973 (38 FR 9599).

Concern was expressed as to the tentative nature of the appendix N retrofit projections. Section 4(c)(i) of appendix N specifies that candidate retrofit approaches must be evaluated to assure that they are potentially capable of achieving the implementation goals. In addition, the source surveillance requirements of § 51.19(d) serve as a safeguard measure to effect remedial actions as necessary. States lacking testing facilities may utilize those of commercial laboratories or certified test data from manufacturers of retrofit devices.

The accuracy of the automobile emission factors and of 1975–76 model year deterioration factors was questioned. The basic data were obtained from about 1,000 automobiles selected at random, according to the national age and model mix, from 6 large cities in different parts of the country. The values are considered representative and reflect any tampering with emissions control devices that may have occurred. Some extremely high emissions values were retested to verify the emissions, but all data were used. The 1975–76 model year factors were based on the available data at the time of the notice of proposed rulemaking preparation and no better source is known than the National Academy of Sciences Report referred to in the EPA document "An Interim Report on Motor Vehicle Emission Estimation," October 1972. A subsequent report has become available and is being reviewed. Changes, if any, to motor vehicle emission factors will be made in subsequent revisions to EPA Report AP–42 as provided in § 51.14(f). The deterioration factors for 1975–76 model year vehicles also are based on the best available data and do not assume any maintenance to catalysts before expiration of the warranty. Therefore, these factors are believed conservative.

The time frame and practical considerations do not allow for contingencies dependent upon a final decision in *International Harvester* v. *Environmental Protection Agency*, case No. 72–1517 (D.C. Cir.), rendered on February 10, 1973. Revised 1975 automobile emissions factors reflecting the automobile suspension decision of April 11, 1973, have not yet been developed. Any revisions made to light duty "truck" (not yet clearly defined) standards, as well as revisions to the 1975 automobile emissions factors resulting from the automobile suspension decision, will be reflected in the EPA report "Compilation of Air Pollutant Emission Factors." Transportation control plans will be required to be suitably modified in accordance with revision procedures.

It was pointed out that § 51.14(a)(2) and appendix I direct the use of emission factors and methodology other than those prescribed in § 51.14(f). Consequently, § 51.14(a)(2) and appendix I have been deleted.

Some comments suggested that both the States and EPA should file environmental impact statements (EIS's) in connection with their actions on transportation control plans. There is no authority under the National Environmental Policy Act (NEPA) to require States to file EIS's. Furthermore, NEPA is not applicable to the action of EPA in approving State implementation plans. *Appalachian Power Co., et al.* v. *Environmental Protection Agency* (4th Cir. 1973), — F. 2d —, No. 72–1733 motion denied April 11, 1973, Slip Opinion at 28. Nevertheless, the Administrator does encourage States to consider the total impact on the environment for all strategies proposed.

An environmental group suggested that detailed guidance be provided concerning strategies designed to reduce motor vehicle use. It is not possible at this time to develop meaningful generalizations about the effectiveness of such strategies. Consequently, detailed guidance as to requirements and estimated emissions reductions for these strategies was not incorporated.

It was also suggested that an appendix be added listing enforcement guidelines for the States. EPA considers that this subject is adequately covered in these amendments.

The Agency finds that good cause exists for making these amendments effective June 5, 1973, to insure that all interested parties are formally notified as to the parameters that will be considered in the Administrator's review and evaluation of transportation control plans. Pursuant to the appelate court order, the Administrator must approve or disapprove such plans by June 15, 1973.

Dated May 25, 1973.

ROBERT W. FRI,
Acting Administrator.

Part 51 of title 40, Code of Federal Regulations, is amended as follows:

1. In § 51.1, new paragraphs (r), (s), (t), (u), (v), (w), and (x) are added as follows:

§ 51.1 Definitions.

* * * * *

(r) "Transportation control measure" means any measure, such as reducing vehicle use, changing traffic flow patterns, decreasing emissions from individual motor vehicles, or altering existing modal split patterns that is directed toward reducing emissions of air pollutants from transportation sources.

(s) "Vehicle trip" means any movement of a motor vehicle from one location to another that results in the emission of air pollutants by the motor vehicle.

(t) "Trip type" means any class of vehicle trips possessing one or more characteristics (e.g., work, nonwork; peak, off-peak; freeway, nonfreeway) that distinguish vehicle trips in the class from vehicle trips not in the class.

(u) "Vehicle type" means any class of motor vehicles (e.g., precontrolled, heavy duty vehicles, gasoline powered trucks) whose emissions characteristics are significantly different from the emissions characteristics of motor vehicles not in the class.

(v) "Traffic flow measure" means any measure, such as signal light synchronization, freeway metering and curbside parking restrictions, that is taken for the purpose of improving the flow of traffic and thereby reducing emissions of air pollutants from motor vehicles.

(w) "Roadway type" means any class of roadway facility that can be broadly categorized as to function and assigned average speed and capacity values, e.g., expressway, arterial, collector, and local.

(x) "Time period" means any period of time designated by hour, month, season, calendar year, averaging time, or other suitable characteristics, for which ambient air quality is estimated.

2. In § 51.4, paragraph (f) is added as follows:

§ 51.4 Public hearings.

* * * * *

(f) The State shall, prior to adoption of transportation control measures, conduct one or more public hearings as required in paragraphs (a) through (d) of this section.

3. In § 51.5, paragraphs (d) and (e) are added as follows:

§ 51.5 Submission of plans; preliminary review of plans.

* * * * *

(d) Submission to the Administrator shall be accomplished by delivering 10 copies of the transportation control portions of the plan to the appropriate regional office. Such portions shall be adopted by the State and submitted by the Governor.

(e) Upon request of a State, the Administrator will provide preliminary review of the draft transportation control measures or portions thereof in advance of the date such measures are due. Such requests shall be made as provided in paragraph (c) of this section and shall not operate to relieve a State of its responsibility for adopting and submitting transportation control measures in accordance with prescribed due dates.

4. In § 51.14, paragraph (a)(2) is revised, paragraphs (c)(1) and (c)(5) are revised, paragraphs (f), (g), and (h) are added, and appendix I is deleted. As amended, § 51.14 reads as follows :

§ 51.14 Control strategy: Carbon monoxide, hydrocarbons, photochemical oxidants, and nitrogen dioxide.

* * * * *

(a) * * *

(2) The plan shall contain:

(i) A description of enforcement methods including, but not limited to, procedures for monitoring compliance with the selected traffic control measures, procedures for handling violations, and a designation of enforcement responsibilities (i.e., air pollution control agency, State police, State Department of Motor Vehicles, State Registrar of Motor Vehicles, etc.).

(ii) Proposed or adopted rules and regulations pertaining to the selected transportation control measures.

(iii) A description of administrative procedures to be used in implementing all selected transportation control measures, including, but not limited to, methods of achieving transportation improvements and a designation of responsibility for administration of such procedures (e.g., State Treasurer responsible for purchase of buses).

(iv) A schedule designating dates by which legal authority necessary to implement the plan will be obtained, other significant steps in the implementation of the plan will be achieved, and each control measure will be implemented.

(c) *Adequacy of control strategy (1).*—The plan shall demonstrate, by means of a proportional model or diffusion/photochemical model or other procedure which is adequate and appropriate, that the control strategy included in each plan for a region classified as priority I is adequate for attainment and maintenance of the national standard(s) to which such control strategy applies. Control measures shall not result in an increase in the concentration of any pollutant to a level that exceeds a national ambient air quality standard. The plan shall include provisions as necessary to prevent such increases in concentrations as a result of traffic increases that may be stimulated by transportation control measures.

* * * * *

(5) The plan shall show that the control strategy including transportation control measures will result in the degree of emissions reduction indicated to be necessary by a proportional model, diffusion model, or other procedure which is adequate and appropriate. The plan shall contain a summary of the computations, assumptions and judgments used to determine the emissions reductions that will result from application of the control strategy to each point source, and each group of area sources. Such summary shall be included in a table similar to that presented in appendix D to this part. The plan also shall contain a summary of the data, computations, assumptions and judgments used to develop any transportation control measures that are a part of the control strategy. Such a summary shall as a minimum contain the material described in appendix M to this part. The detailed computations and data shall be retained by the State and made available for inspection by the Administrator at his request.

* * * * *

(f) *Motor vehicle emission factors.*—The States required to submit transportation control plans must, except as noted below, use current emission factors and methodology to calculate emissions from gasoline powered motor vehicles. The current emission factors and methodology are presented in "Compilation of Air Pollutant Emission Factors," EPA Report No. AP–42, and in superseding EPA interim reports. These are available from the EPA, Office of Air Quality Planning and Standards, Research Triangle Park, N.C. 27711. If emissions factors or methodology other than those presented in the EPA report are used, the substantiating justification must be submitted with the transportation control measures.

(g) *Air quality base line.*—The concentrations of carbon monoxide and photochemical oxidants set forth in the State plan as approved and promulgated on May 31, 1972 (37 FR 10842), (part 52 of this chapter), may be used as the air quality base lines for computation of the emissions reductions through transportation control measures required to meet national standards. More recent air quality data should be used where adequate and appropriate. Such data must be compatible with the emissions inventory for the region involved and justification submitted for the appropriateness of

its use. Revised air quality data should be submitted to the appropriate EPA regional office at the earliest possible date for evaluation and approval to preclude plan disapproval resulting from the use of faulty air quality data.

(h) *Transportation control strategies.*—Information and requirements for States which are considering transportation control measures involving inspection, maintenance, and retrofit of in-use motor vehicles are presented in appendix N to this part.

5. In § 51.19, paragraph (d) is added as follows:

§ 51.19 Source surveillance.

* * * * *

(d) Procedures for obtaining and maintaining data on actual emissions reductions achieved as a result of implementing transportation control measures. In the case of measures involving inspection, maintenance, or retrofit, these data shall include the results of an emission surveillance program designed to determine actual average per vehicle emissions reductions attributable to inspection, maintenance, and/or retrofit. In the case of measures based on traffic flow changes or reductions in vehicle use, the data shall include observed changes in vehicle miles traveled (VMT) and average speeds. The data shall be maintained in such a way as to facilitate comparison of the planned and actual efficacy of the transportation control measures.

6. In this part, appendix M is added as follows:

APPENDIX M—TRANSPORTATION CONTROL SUPPORTING DATA SUMMARY

When transportation control measures of any type are to be imposed, the plans shall contain a summary of the data, computations, and rationale used to develop the transportation control measures that will result in the required reduction of emissions. Such a summary shall, as a minimum, contain the material described below. Suggested procedures for obtaining and coding information about air pollutant emissions from stationary and mobile sources have been published.[1] The detailed computations and data shall be retained by the State agency and made available for inspection by the Administrator at his request.

1. The transportation control plan shall display total emissions of hydrocarbons (HC), carbon monoxide (CO), and nitrogen oxides (NOx), subdivided into emissions from mobile and stationary sources, that will occur with and without implementation of the transportation control measures in each region or subregion and time period in which a proportional or other air quality model is used to determine air quality. These data shall be projected for at least 5 years in 1-year intervals starting with the year in which the national ambient air quality standards are to be achieved. The data shall be displayed in a format similar to table 1.

2. If the transportation control measures, either in their application or their effect, distinguish between trip types or vehicle types, the transportation control plan shall display vehicle miles traveled and emissions of HC, CO, and NOx due to each trip type or vehicle type that will occur with and without implementation of the transportation control measures in each region or subregion and time period in which a proportional or other air quality model is used to determine air quality levels. A stategy that results in different percent emissions reductions of HC, CO, or NOx for different trip or vehicle types should distinguish between trip or vehicle types in its effect. The data shall be displayed in a format similar to table 2.

3. If the transportation control measures include traffic flow measures, the transportation control plan shall display average speeds and vehicle miles traveled according to roadway type (freeway, arterial, local/collector) that will occur with and without implementation of the transportation control measures in each region or subregion and time period in which proportional or other air quality model is used to determine air quality levels. The plan shall also display emissions of HC, CO, and NOx from mobile sources, subdivided according to roadway type, that will occur with and without implementation of the transportation control measures in each region or subregion and time period in which a proportional or other air quality model is used to determine air quality. The data shall be displayed in a format similar to table 2.

4. If the effectiveness of the transportation control measures depends in whole or in part on voluntary public response to changes in prices or taxes, mass transit improvements, or other incentives or disincentives affecting vehicle emissions, travel frequency, mode, location, time of day, or other characteristics of travel demand, the transportation control plan shall display the demand elasticities or other appropriate quantitative measures of public response to such incentives or disincentives that were used to evaluate the effects on emissions of the incentives or disincentives. The sources of these elasticities or other quantitative measures shall be described.

5. The sources of all traffic data, such as vehicle miles traveled and speeds by trip type, vehicle type, and roadway type, used in evaluating the effects upon air quality of the transportation control measures shall be described in the transportation control plan.

6. The assumptions, judgments, and computations used to develop the information in items 1 through 4 above shall be summarized in the transportation control plan.

A transportation control plan that fails to include any element of data required by this appendix will be acceptable only if the plan presents the data and analytic procedures used to estimate the effects on air quality of the selected transportation control measures and provides adequate justification for the use of such data and procedures.

TABLE 1

The data required by paragraph 1 shall be displayed in a table similar to the following:

	Emissions[1]			
	Mobile		Stationary	
	With transportation control measures	Without transportation control measures	With transportation control measures	Without transportation control measures
Time period 1:				
Sub region 1				
Sub region 2				
Sub region 3				
Sub region 4				
Sub region 5				
Time period 2:				
Sub region 1				
Sub region 2				
Sub region 3				
Sub region 4				
Sub region 5				
Other time periods as needed:				
Sub region 1				
Sub region 2				
Sub region 3				

[1] Indicate pollutant.

TABLE 2

The data required by paragraphs 2 and 3 above shall be displayed in a table similar to the following:

Sub region .....
Time region .....

		EMISSIONS[1] (OR VMT OR SPEEDS)[2]				
		Vehicle type (1)		Vehicle type (2)		
Trip type	Roadway type	With transportation control measures	Without transportation control measures	With transportation control measures	Without transportation control measures	Continue with other vehicle types as appropriate
Work	Freeway					
	Arterial					
	Collector					
	Local					
Shopping	Freeway					
	Arterial					
	Collector					
	Local					

Continue with other trip types as appropriate.

[1] Indicate pollutant.

[2] The table need contain only those entries appropriate to the transportation control measures included in the plan.

[1] Environmental Protection Agency, "A Guide for Compiling a Comprehensive Emission Inventory," APTD-1135, June 1972, available from Air Pollution Technical Information Center, EPA, Research Triangle Park, N.C. 27711.

7. In this part, appendix N is added as follows:

APPENDIX N—EMISSIONS REDUCTIONS ACHIEVABLE THROUGH INSPECTION, MAINTENANCE AND RETROFIT OF LIGHT DUTY VEHICLES

1. *General.*—This appendix presents estimates of emissions reductions that, in the judgment of the Administrator, are likely to be achievable through application of inspection, maintenance, and retrofit measures to in-use motor vehicles. To the extent possible, these estimates are based on empirical data. However, lack of data in some areas has necessitated some extrapolation of empirical data using engineering judgment. It should be noted that, for inspection/maintenance, estimates of changes in oxides of nitrogen are not included in the discussion. In general, oxides of nitrogen were not significantly affected by inspection/maintenance procedures. The sources of empirical data and the bases for judgments are discussed in paragraph 6 of this appendix.

The emissions reductions estimates presented herein are subject to considerable uncertainty. The emissions reductions actually realized in a transportation control program may be greater or less than the estimated reductions. The estimates should therefore be regarded as useful primarily for current planning purposes. Any transportation control plan incorporating in-use vehicle emission control approaches, whether those specifically cited in this appendix or alternatives proposed by a State, must provide, as required by 40 CFR 51.19d, for field verification of the emissions actually achieved in the implemented programs and, as required by section 110(a)(2)(H) of the Act, for any revisions of the transportation control plan that may be indicated thereby.

The approaches to in-use vehicle emissions control cited herein are those judged to be most generally applicable by the Administrator considering the information currently available to him. States are encouraged to consider other approaches that may be applicable to their particular situations. Data and analyses supporting the emissions reductions claimed for alternative approaches must be submitted with the Transportation Control Plan. Several alternative approaches are discussed in a report entitled: "Control Strategies for In-Use Vehicles," available from EPA, Mobile Sources Pollution Control Program, 401 M Street SW., Washington, D.C. 20460.

States proposing inspection/maintenance or retrofit programs are encouraged to consider the effects on the implementation of their plans of inequities that may arise in connection with these programs. Such inequities may include premature failure or inadequacy of retrofit components, improper or inadequate workmanship at inspection and repair facilities, inconvenient numbers, locations, and operating schedules for inspection, retrofit, and repair facilities, and inadequate public notice of inspection maintenance and retrofit requirements.

The States are also encouraged to give consideration to transportation control measures based on reductions in vehicle use and traffic flow measures. Nothing in this appendix is intended to suggest that transportation control approaches based on inspection, maintenance, and retrofit should necessarily be considered preferable to approaches based on reductions in vehicle use or traffic flow measures.

2. *Definitions.*—a. "Precontrolled vehicles" means light duty vehicles sold nationally (except in California) prior to the 1968 model-year and light-duty vehicles sold in California prior to the 1966 model-year.

b. "Controlled vehicles" means light-duty vehicles sold nationally (except in California) in the 1968 model-year and later and light-duty vehicles sold in California in the 1966 model-year and later.

c. "Loaded emissions test" means a sampling procedure for exhaust emissions which requires exercising the engine under stress (i.e., loading) by use of a chassis dynamometer to stimulate actual driving conditions. As a minimum requirement, the loaded emission test must include running the vehicle and measuring exhaust emissions at two speeds and loads other than idle.

d. "Idle emission test" means a sampling procedure for exhaust emissions which requires operation of the engine in the idle mode only. At a minimum, the idle test must consist of the following procedures carried out on a fully warmed-up engine: a verification that the idle revolutions per minute is within manufacturer's specified limits and a measurement of the exhaust carbon monoxide and/or hydrocarbon concentrations during the period of time from 15 to 25 seconds after the engine either was used to move the car or was run at 2,000 to 2,500 r/min with no load for 2 or 3 seconds.

e. "Retrofit" means the addition or removal of an item of equipment, or a required adjustment, connection, or disconnection of an existing item of equipment, for the purpose of reducing emissions.

f. "Inspection/maintenance" means a program to reduce emissions from in-use vehicles through identifying vehicles that need emissions control related maintenance and requiring that maintenance be performed.

g. "Idle adjustments" means a series of adjustments which include idle revolutions per minute, idle air/fuel ratio, and basic timing.

h. "Initial failure rate" means the percentage of vehicles rejected because of excessive emissions of a single pollutant during the first inspection cycle of an inspection/maintenance program. (If inspection is conducted for more than one pollutant, the total failure rate may be higher than the failure rates for each single pollutant.)

3. *Inspection/maintenance of light duty vehicles.*—(a) *Reductions.*—(i) *Loaded emission tests.*—The following average annual reductions in vehicular exhaust emissions as a function of initial failure rates are estimated to be achievable through implementation of an inspection/maintenance program using a loaded emission test:

Percent initial failure rate	10	20	30	40	50
Emission reduction (percent):					
Hydrocarbons	8	11	13	14	15
Carbon monoxide	4	7	9	11	12

(ii) *Idle emission test.*—The following average annual reduction in vehicular exhaust emissions as a function of rejection rate are estimated to be achievable through implementation of an inspection/maintenance program using an idle test:

Percent initial failure rate	10	20	30	40	50
Emission reduction (percent):					
Hydrocarbons	6	8	10	11	11
Carbon monoxide	3	6	8	9	10

To obtain these reductions an inspection/maintenance program must provide for inspection of each vehicle at least once per year. More frequent inspection and maintenance is expected to provide larger average emissions reductions, although at greater cost. During the first inspection cycle of an inspection/maintenance program, emissions reductions may be assumed only to the extent consistent with the portion of the vehicle population that has been inspected by that time. During subsequent years the full reductions shown in the tables may be assumed provided that the emissions levels which correspond to the appropriate initial failure rate are used as failure criteria.

(b) The average reductions cited above are applicable for all gasoline-powered light-duty motor vehicles (except motorcycles) which are included in the inspection/maintenance program.

(c) *Requirements.*—An acceptable inspection/maintenance program must include:

(i) Provisions for regular periodic inspection of all vehicles for which emissions reductions are claimed.

(ii) Provisions for the establishment of inspection failure criteria consistent with the claimed reductions.

(iii) Provisions to insure that necessary vehicles receive the maintenance necessary to achieve compliance with the inspection standards. This might include sanctions against individual owners or repair facilities, retest of failed vehicles following maintenance, a certification program to insure that repair facilities performing the required maintenance have the necessary equipment, parts and knowledge to perform the tasks satisfactorily, a program to train mechanics and/or other measures.

(iv) A program of enforcement to insure that vehicles are not intentionally readjusted or modified subsequent to the inspection/maintenance in such a way as would cause them to no longer comply with the inspection standards. This might include spot checks of idle adjustments and/or a suitable type of physical tagging.

(d) *Alternative approaches.*—Inspection/maintenance programs employing approaches other than emissions testing may be capable of achieving emissions reductions for vehicles of certain model-years. Extensive engine parameter inspection and mandatory maintenance procedures are discussed in the Environmental Protection Agency report "Control Strategies for In-Use Vehicles." Inspection/maintenance approaches other than those using an emissions test, or emissions reductions greater than those cited in paragraph 3(a) will be acceptable only if sufficient data are provided to justify the emissions reductions claimed.

4. *Retrofit of light duty vehicles.*—(a) *Reductions.*—The following reductions in exhaust emissions per vehicle are estimated to be achievable through the installation of the cited types of retrofit devices on the classes of vehicles noted. These emissions reduction estimates are provided for planning purposes only. States including retrofit in their transportation control plans must determine, prior to the actual installation of retrofit devices, that the specific devices selected (e.g., brand A oxidizing catalytic converters) satisfy the requirement of paragraph 4(c)(i).

Since retrofitted vehicles are expected to be subject to periodic inspection and maintenance (see paragraph 4(c)), the reductions cited are to be applied to a maintained vehicle emissions baseline. For example, if a 12 percent reduction in hydrocarbon emissions is claimed for inspection/maintenance, the reduction in hydrocarbon emissions due to a retrofit approach should be calculated after the vehicle's original emission rate for hydrocarbons has been reduced by 12 percent.

(i) Precontrolled vehicles:

Retrofit option	Average reduction per vehicle		
	HC	CO	NOx
	Percent		
Lean idle air/fuel ratio adjustment and vacuum spark advance disconnect	25	9	23
Oxidizing catalytic converter and vacuum spark advance disconnect	68	63	48
Air bleed to intake manifold	21	58	0
Exhaust gas recirculation and vacuum spark advance disconnect	12	31	48

(ii) Controlled vehicles:

Retrofit option	Average reduction per vehicle		
	HC	CO	NOx
	Percent		
Oxidizing catalytic converter	50	50	0
Exhaust gas recirculation	0	0	40
Oxidizing catalytic converter and exhaust gas recirculation	50	50	40

During the installation phase of a retrofit program, emissions reductions may be assumed only to the extent consistent with the portion of the vehicle population on which retrofit devices have been installed by that time.

(b) *Applicability.*—The emissions reductions cited above for precontrolled vehicles are applicable to all gasoline-powered light-duty motor vehicles (except motorcycles) sold nationally (except in California) prior to the 1968 model-year or in California prior to the 1966 model-year.

The emissions reductions cited above for installation of oxidizing catalytic converters on controlled vehicles are applicable to all gasoline-powered light-duty motor vehicles (except motorcycles) sold nationally (except in California) in the 1968 through 1974 model-years or in California in the 1966 through 1974 model-years.

The emissions reductions cited above for installation of exhaust gas recirculation on controlled vehicles are applicable to all gasoline-powered light-duty motor vehicles (except motorcycles) sold nationally (except in California) in the 1968 through 1972 model-years or in California in the 1966 through 1971 model-years.

(c) *Requirements.*—An acceptable retrofit program must include:

(i) The use of a retrofit device whose potential capability for achieving the claimed emissions reductions has been demonstrated through testing and evaluation using the 1972 or 1975 Federal emission test procedure.

(ii) A method of assuring the availability of installation facilities and personnel with the capability to perform the required installation tasks and a method of assuring the availabilty of an adequate supply of retrofit components.

(iii) Provisions for emissions testing at the time of retrofit installation or some other positive assurance that the retrofit device is installed and operating correctly.

(iv) Provisions for inspection of each retrofitted vehicle at least once per year.

(v) Provisions for the establishment of inspection standards for retrofitted vehicles consistent with the emissions reductions claimed. Particular attention must be paid in this regard to catalytic converter retrofits as the reductions cited in paragraph 4(a) do not include possible irreversible catalyst deterioration over time.

(vi) Provisions to insure that vehicles failing inspection receive the maintenance necessary to achieve compliance with the inspection standards.

(vii) In the case of retrofit programs that include the use of catalytic converters requiring unleaded fuel, provisions to insure that vehicles utilizing this type of retrofit will not use leaded gasoline and that adequate supplies of lead-free gasoline of suitable octane value will be available if Federal regulations will not insure availability, and provided that such provisions are not in violation of section 211(c)(4) of the Act.

(viii) A program of enforcement to insure that vehicles are not intentionally adjusted or modified subsequent to retrofit installation in such a way as would cause them to no longer comply with the retrofit emissions standards. This might include spot checks, visual inspection, or other suitable techniques.

(d) *Alternative approaches.*—Retrofit programs employing approaches other than those cited above may be capable of achieving emissions reductions for vehicles of certain model-years. For example, addition of vacuum spark advance disconnect to the air bleed to intake manifold approach may be feasible for precontrolled vehicles. Alternative retrofit approaches or retrofit emissions reductions greater than those cited in paragraph 4(a) will be acceptable only if sufficient data and analyses are provided to justify the emissions reductions claimed.

5. *Inspection/maintenance or retrofit of vehicles other than light-duty vehicles.*—The inspection/maintenance and retrofit approaches discussed above may be applicable to certain classes of motor vehicles other than those cited. In particular, the States are encouraged to consider the application of such approaches to motor vehicles in the 6,000 to 10,000 lb GVW class. In many cases, these vehicles are constructed and operated in a manner similar to light-duty vehicles. However, the present lack of test data for application of inspection/maintenance or retrofit approaches to vehicles of this type prevents the inclusion of data on achievable emissions reductions for such vehicles in this appendix. Transportation control strategies employing inspection/maintenance or retrofit of vehicles other than light-duty vehicles will be acceptable only if sufficient data and analyses are provided to justify the emissions reductions claimed.

6. *Bases for emissions reductions cited in paragraphs 3 and 4.*—(a) *Inspection/maintenance.*—The reductions cited in paragraph 3.a for inspection/maintenance were derived from test data obtained by EPA in evaluating the initial emissions reductions achieved when a fleet of precontrolled and controlled light-duty vehicles were subjected to emissions inspection tests and the vehicles failing the test were serviced in private maintenance garages. The observed average initial reductions were approximately twice the values shown in the tables in paragraph 3a.

It is expected that in an actual inspection/maintenance program the average emissions reductions achieved will be substantially less than the initial reductions observed in the study, since there will be deterioration of emissions-related components and adjustments between periodic inspection and maintenance events. While the currently available data on such deterioration are inadequate to accurately predict the consequences of this effect, some correction for deterioration is necessary. Therefore, giving consideration to the current frequency of voluntary maintenance and the emissions reductions typically achieved by existing maintenance procedures, it has been assumed that linear deterioration to before-maintenance emissions levels will occur over the 12-month period following maintenance. As a result, the average effectiveness for annual inspection is estimated to be one-half of the initial effectiveness following maintenance.

Data on the effectiveness of inspection/maintenance programs in reducing emissions are available only for light-duty vehicles through the 1971 model-year. The effectiveness of inspection/maintenance programs in reducing emissions from future model year vehicles will depend primarily on the extent to which emissions from those vehicles increase in use as a result of repairable malfunctions and on the ability of the inspection test to accurately identify vehicles having such malfunctions. These factors can be evaluated only after substantial numbers of such vehicles have been in use for some time. However, for implementation planning purposes, it has been assumed that emissions reductions estimated to be achievable for current light-duty vehicles will be applicable for future-model model years as well.

Inspection and maintenance programs using engine parameter inspection or mandatory maintenance approaches may also be effective for vehicles of certain model years. However, such approaches must be tailored to relate to the specific engine and emissions control systems of the vehicles to be inspected and/or maintained. Depending upon inspection and maintenance procedures and the number and choice of engine parameters included in the program, substantial variations in emissions reductions are to be expected. Generally applicable estimates of the emissions reductions that may result from such programs are not now available.

States considering inspection and/or maintenance programs based on approaches not involving emissions tests should take the factors mentioned above into account where estimating and justifying emissions reductions expected from such programs. More detailed discussion of these matters may be found in the EPA report "Control Strategies for In-Use Vehicles."

(b) *Retrofit.*—(i) *Precontrolled vehicles.*—The reductions cited in paragraph 4.a for precontrolled vehicles are based upon test data obtained in evaluating the initial emissions reductions obtained when various types of retrofit emission control systems were fitted to fleets of tuned, precontrolled, light-duty vehicles. The results of these studies are presented in the EPA report "Control Strategies for In-Use Vehicles." In each case, the mean emissions reductions observed have been adopted as being most representative of the initial emissions reductions which may be achieved in an actual retrofit program.

Only very limited data are currently available on the deterioration of emissions performance of retrofitted vehicles. These data, which are discussed in the EPA report "Control Strategies for In-Use Vehicles," indicate the need for periodic inspection and maintenance of retrofitted vehicles if the attainment and maintenance of the retrofit emissions reductions cited in paragraph 4.a is to be assured. Based upon the available data and the requirements for inspection and maintenance of retrofitted vehicles at least once per year, and considering the nature of the emissions control techniques employed in each retrofit approach, it appears that the average annual emissions reductions per retrofitted vehicle can approach the observed mean initial reductions if suitable inspection and maintenance criteria are adopted. Accordingly, it has been assumed for planning purposes that the observed initial emissions reductions will not be affected by deterioration.

(ii) *Controlled vehicles.*—Data which could serve as a basis for estimating emissions reductions achievable through retrofitting controlled light-duty vehicles are quite limited. As a result, the emissions reductions cited for this class of vehicles in paragraph 4.a were developed by extrapolating the data for retrofitting precontrolled light-duty vehicles.

The techniques of lean idle air/fuel ratio adjustment, vacuum spark advance disconnect, and air bleed to intake manifold are not considered to be generally applicable to controlled vehicles. This is because these emissions control approaches are either incorporated into or may be inconsistent with emissions control techniques already applied to many controlled vehicles.

Exhaust gas recirculation (EGR) is considered generally applicable only to those vehicles not substantially controlled for nitrogen oxides emissions. Therefore, EGR as a retrofit approach is applicable in 1968 through 1972 models sold nationwide (outside of California), except for an insignifi-

cant number of 1972 vehicles already equipped with EGR. Incorporation of EGR into a significant number of 1972 models sold in California limits the general applicability of this retrofit approach to 1966 through 1971 controlled vehicles sold in California.

Oxidizing catalytic converters are considered to be potentially applicable as retrofits through the 1974 model-year. Beyond the 1974 model-year, the presently anticipated design of emissions control systems required to meet Federal new car emissions standards is considered to preclude retrofitting using currently available retrofit technology.

The following paragraphs describe the basis for the emissions reductions cited for retrofit of controlled vehicles.

Oxidizing catalytic converters.—Test data indicate that catalytic converter retrofits to precontrolled vehicles can achieve emissions reductions of 68 percent (hydrocarbons, 63 percent (carbon monoxide), and 48 percent (nitrogen oxides) when combined with vacuum spark advance disconnect. Presently available data suggest that deterioration may not be significant with retrofit-type catalysts.

Experience to date with prototype 1975 emissions control systems suggests that retrofit catalytic converters are capable of achieving substantial reductions of hydrocarbon and carbon monoxide emissions from controlled light-duty vehicles. While studies of precontrolled vehicles have provided evidence that retrofit catalysts may also achieve some reduction of nitrogen oxides emissions, the extent of this reduction is too highly dependent on the air/fuel ratio in the catalyst to be extrapolated to controlled vehicles with reasonable certainty.

In experiments conducted to date, installation of retrofit catalysts on precontrolled vehicles has been accompanied by vacuum spark advance disconnect. In addition, a lean idle air/fuel ratio adjustment has normally been included in the installation procedures. As neither of the latter two modifications is generally applicable to controlled vehicles, it is prudent to anticipate that reductions of hydrocarbon and carbon monoxide emissions achieved by retrofit catalysts on controlled vehicles may be less than those observed with precontrolled vehicles.

The cited emissions reductions of 50 percent (hydrocarbons), 50 percent (carbon monoxide) and 0 percent (nitrogen oxides) are estimates consistent with the foregoing considerations and the results obtained with precontrolled vehicles.

Exhaust gas recirculation (EGR).—Emissions reductions of 12 percent (hydrocarbons), 31 percent (carbon monoxide), and 48 percent (nitrogen oxides) have been observed as a result of retrofitting precontrolled light-duty vehicles with EGR accompanied by vacuum spark advance disconnect. Experience with 1973 emissions control systems for new cars suggests that EGR retrofits can achieve substantial reductions of nitrogen oxides emissions from controlled vehicles not already equipped with EGR or equivalent nitrogen oxides emissions control systems.

Much of the hydrocarbon control and some of the nitrogen oxides control observed with EGR retrofits to precontrolled vehicles is attributable to the vacuum spark advance disconnect. This is not generally applicable to controlled vehicles. In addition, the design features responsible for much of the carbon monoxide reduction observed with precontrolled vehicles are likely to be already incorporated into many controlled vehicles. It is therefore prudent to expect that EGR retrofits to controlled vehicles may achieve somewhat smaller reductions of nitrogen oxides emissions than have been observed with precontrolled vehicles and no reductions of hydrocarbon and carbon monoxide emissions.

The cited emissions reductions of 0 percent (hydrocarbons and carbon monoxide) and 40 percent (nitrogen oxides) are estimates consistent with the foregoing considerations and the results obtained with precontrolled vehicles.

EGR and oxidizing catalytic converter retrofits for controlled vehicles affect different pollutants and operate independently on different parts of the engine. Therefore, when the two retrofits are combined, the emissions reductions obtained from each can be considered additive.

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